REMARKS

Favorable reconsideration and allowance of the claims of the present application are respectfully requested.

Before addressing the various issues raised in the present Office Action, applicants have amended Claims 1-11 and 14-41; cancelled Claims 12, 13 and 42; and have added new Claims 43-53.

In each of Claims 1-11 and 14-41, the term "characterized in that" has been replaced by the term "comprising" or "wherein". In Claim 1, the term "biomass hydrolysate" has been changed to read as "hydrosylate of xylan-containing vegetable material". Support for this amendment to Claim 1 is found at Page 4, line 35-Page 5, line 6 of the instant application. In the dependent claims that recite the term "biomass hydrosylate" the same has been changed to read as "hydrosylate".

The preferred (or alternative) embodiments in original Claims 3, 4, 5, 7, 15, 16 and 17 have been presented in new Claims 43-53. Applicants have also deleted the multiple dependencies of original Claims 5 to 42.

In Claim 37, the term "reverse osmosis" has been added as one of the possible post treatment steps. Support for this amendment to Claim 37 is found at Page 9, line 6 of the specification of the instant application,

Furthermore, the reference to trademarks NF-200 and Desal-5 DK have been replaced in Claim 26 by the description of these membranes which is support by the description found at Page 10, lines 19-32 of the specification of the instant application.

Since the above amendments to the claims do not introduce any new matter into the specification, entry thereof is respectfully requested.

In the present Office Action, Claims 5-42 are objected to under 37 C.F.R. § 1.75(c) as allegedly being in improper form because a multiple dependent claim cannot depend from another multiple dependent claim.

In response to this objection to Claims 5-42 and as stated above, applicants have amended Claims 5-42 by removing the multiple-dependencies from the claims. In light of the above amendments to the claims, the objection to Claims 5-42 under 37 C.F.R. § 1.75 (c) has been obviated. Applicants thus respectfully request reconsideration and withdrawal of the instant objection of Claim 5-42.

The Office Action also rejects the claims under 35 U.S.C. § 112, second paragraph as allegedly being indefinite for the reasons mentioned under item 2 of the present Office Action.

As stated above, applicants have amended Claims 3, 4, 5, 7, 15, 16 and 17 by deleting the preferred (or alternative) embodiments from the claims. The preferred (or alternative) embodiments have been presented in new Claims 43-53. In view of the amendments to Claims 3, 4, 5, 7, 15, 16 and 17, applicants respectfully submit that the rejection under 35 U.S.C. § 112, second paragraph, has been obviated. Reconsideration and withdrawal of the indefiniteness rejection are thus respectfully requested.

Claims 1-4 stand rejected under 35 U.S.C. § 103 as allegedly unpatentable over the combined disclosures of U.S. Patent No. 6,409,841 to Lombard ("Lombard"), U.S. Patent No. 6,329,182 to Pedersen, et al. ("Pedersen, et al.") and U.S. Patent No. 6,086,681 to Lindroos, et al. ("Lindroos, et al.").

Applicants respectfully submit that the combined disclosures of Lombard, Pedersen, et al., and Lindroos, et al. do not render Claims 1-4 (together with Claims 5-11, 14-41 and 43-53) obvious since the combination of applied references do not teach or suggest applicants' claimed process of producing a xylose solution from a hydrolysate of a xylan-containing vegetable material that is recited in amended Claim 1. Specifically, the combined disclosures of Lombard, Pedersen, et al., and Lindroos, et al. do not teach or suggest a process that includes the steps of subjecting a hydrolysate of a xylan-containing vegetable material to nanofiltration and then recovering as a nanofiltration permeate a solution enriched in xylose.

The claimed process provides a very efficient technique of recovering and purifying xylose from a hydrolysate of xylan-containing vegetable material. It was found that very efficient enrichment of xylose in the nanofiltration permeate was achieved using the process of the present invention.

A surprising feature of the nanofiltration process of the present invention is that it was unexpectedly found that the nanofiltration process of the present invention even causes the enrichment of xylose and other pentose sugars (i.e., five-carbon sugars) in regard to hexose sugars (i.e., six-carbon sugars), such as glucose. Reference is made to Tables Va, Vb, VI and VIIc in the specification which show the content of xylose and glucose in the nanofiltration feed and in the nanofiltration permeate, respectively. It can be seen that the relation of xylose to glucose in the nanofiltration permeate is always essentially higher than that in the feed.

Referring for example to Table Vb (page 20), the relation of xylose to glucose in the nanofiltration feed is 29.8:3.9 (=7.6), whereas the corresponding relation in the

nanofiltration permeate is 69.0:3.9 (=24.6) for a Desal-5 DK membrane, 65.0:1.9 (=34.2) for a Desal-5 DK membrane, and 64.0:3.9 (=16.4) for an NF-200 membrane. In Table VI (see Page 21), the relation of xylose to glucose in the nanofiltration feed is 12.5:1.9 (=6.6), whereas the corresponding relation in the nanofiltration permeate is 64.8:3.2 (=20.3) for a Desal 5 DK membrane. In Table VIIc (see Page 24), the relation of xylose to glucose in the nanofiltration feed is 50.4:4.1 (=12.3), whereas the corresponding relation in the nanofiltration permeate is 76.0:0.2 (=38.0) for a Desal 5 DK membrane. Even the results of Table Va (See Page 19) follow the same lines, i.e., the relation of xylose to glucose in the permeate is always higher than in the feed.

The enrichment of xylose in regard to glucose can be considered surprising since both xylose and glucose are monosaccharide sugars having molar masses very close to each other (the molar mass of xylose is 150 and that of glucose is 180). Furthermore, the structures of xylose and glucose (which both represent aldose sugars) are very similar to each other. On the basis of known prior art, a person skilled in the art would have expected the monosaccharides (including xylose and glucose) would have been enriched in the same nanofiltration fraction (either retentate or permeate).

Lombard discloses the processing of a lignocellulose-containing biomass material comprising treating the biomass by dilute acid hydrolysis, alkaline delignification and enzymatic hydrolysis and recovering five- or six-carbon sugars and oligosaccharides produced by the acid processes by nanofiltration to concentrate and separate sugars. In accordance with Col. 6, lines 61-67 and Col. 7, lines 30-32, the nanofiltration membranes concentrate and contain sugars, i.e., all sugars are retained by the nanofiltration

membranes, whereas the nanofiltration permeate is recited to contain only volatile organics and the dilute acid catalyst (See Col. 7, lines 1-3).

Applicants respectfully submit that Lombard does not teach or suggest the recovery of xylose. Furthermore, Lombard does not teach or suggest that xylose can be enriched by nanofiltration so that xylose would be obtained in the nanofiltration permeate, instead of the retentrate. Applicants further observe that Lombard does not teach or suggest that xylose would be enriched in the nanofiltration permeate in regard to hexose sugars.

Pedersen, et al. (which corresponds to WO 99/28490 cited in the specification of the present application at Page 3, lines 23-31) does not alleviate the above defects in Lombard. This secondary applied reference relates to a process for producing oligosaccharide syrups using an enzymatic reaction and subsequent nanofiltration of the saccharide obtained. Monosaccharides are obtained as the nanofiltration permeate, while an oligosaccharide syrup containing disaccharides and higher saccharides (oligosaccharides having a polymerization degree (DP) from 2 to 6) is obtained as the nanofiltration retentate, see FIG. 2. The oligosaccharide syrup (with a low content of the undesired monosaccharides) obtained as the nanofiltration retentate is recovered. For instance, glucose, fructose, galactose, UPD-galactose, mannose and xylose are mentioned representing the undesired monosaccharides (Col. 3, lines 35-37) which are obtained in the permeate. The starting material used for the nanofiltration is a saccharide solution obtained from an enzymatic reaction of e.g., liquefied starch or maltodextrins (see Col. 3, lines 45-47) or disaccharides such as sucrose or lactose (see Col. 3, lines 59-60).

Applicants thus submit that Pedersen, et al. disclose the separation of monosaccharides from disaccharides and higher saccharides, i.e., the difference in the molar masses of the compounds to be separated is at least twofold. Pedersen, et al. do not teach or suggest the separation of compounds having a smaller difference in molar masses, such as the separation of pentose sugars from hexose sugars. Specifically, Pedersen, et al. do not teach or suggest the separation of xylose (pentose sugar) from glucose (hexose sugar).

Furthermore, applicants submit that Pedersen, et al. relates to a different technical field, i.e., to the production of oligosaccharide syrups from a saccharide solution, such as enzymatically treated liquefied starch or maltodextrins. The starting material in the Pedersen, et al. disclosure is not a hydrolysate of a xylan-containing vegetable material. Hence, it cannot be considered obvious that a separation process that works in connection with saccharide syrups is applicable for separating xylose from a hydrolysate of xylan-containing vegetable material.

Even is a person skilled in the art would have attempted the separation of xylose by nanofiltration from other types of starting materials such as spent liquors on the basis of Pedersen, et al., there is nothing in the Pedersen, et al. reference which would have suggested that xylose can be enriched in the nanofiltration permeate in regard to hexose sugars.

Lindroos, et al. do not alleviate the defects in the combined disclosures of Lombard and Pedersen, et al. for the following reasons: Lindroos, et al. disclose a method of crystallizing and recovering xylose from an aqueous solution of xylose by concentrating the solution so as to obtain a solution supersaturated with xylose and then

crystallizing xylose from the supersaturated solution. The starting xylose-containing solution may be for example a biomass hydrolysate, a xylose-containing by product fraction obtained from wood processing industry such as suphite cooking liquor, or a concentrate chromatographically produced from sulphite cooking liquor or an ultrafiltration permeate thereof.

Applicants respectfully submit that Lindroos, et al. do not, in any way, teach or suggest the recovery of xylose by nanofiltration, nor the different behavior of xylose and glucose in the separation by nanofiltration. It is generally known to separate lingosulphates from sugars by ultrafiltration. However, the difference in the molar masses of sugars and lignosulphonates is on the order of ten or more.

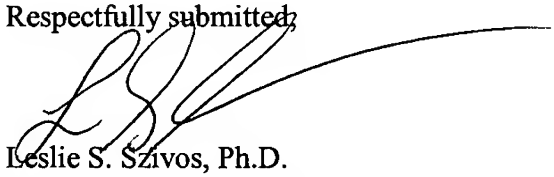
In view of the above comments, applicants submit that the process of recovering xylose by nanofiltration in accordance with the present invention is not obvious from the combined disclosures of Lombard, Pedersen, et al. and Lindroos, et al.

The § 103 rejection also fails because there is no motivation in the applied references which suggest modifying the disclosed processes to include the various elements recited in the claims of the present invention. Thus, there is no motivation provided in the applied references, or otherwise of record, to make the modification mentioned above. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Vaeck, 947 F.2d, 488, 493, 20 USPQ 2d. 1438, 1442 (Fed.Cir. 1991).

The rejection under 35 U.S.C. §103 has been obviated; therefore reconsideration and withdrawal thereof are respectfully requested.

Thus, in view of the foregoing amendments and remarks, it is firmly believed that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,



Leslie S. Szivos, Ph.D.
Registration No. 39,394

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, New York 11530
(516) 742-4343

LSS/sf